Note on some generally accepted Views regarding Vision. By Dr W. Peddie.

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The following beliefs regarding vision meet with very general acceptance :—

First. Very intense light of any wave-length produces practically the sensation of whiteness.

Second. Very weak light of any wave-length produces practically the sensation of whiteness.

Third. A coloured area of normal brightness retains its colour, though with diminished purity, when gazed at steadily for a long time.

Fourth. Small, faintly luminous, objects are seen more easily by indirect vision than by direct vision.

The first and second of these supposed facts are readily accounted for on any of the usual theories of vision. The Young-Helmholtz theory, for example, gives quite as easy an explanation of them as Hering's theory gives. Yet the truth of these supposed facts is by no means a *necessary* result of any of the theories. In a recent paper "On Colour-Vision by very Weak Light" (*Proc. Roy. Soc.*, B 508, 1905), Dr G. J. Burch describes experiments which lead him to the conclusion that the second statement is not necessarily true. In that paper he also refers to the first statement in the following words: "In my paper on Artificial Colour-Blindness" (*Phil. Trans.*, B vol. 191, 1899), "I described experiments showing that Hering's argument in favour of a black-white sensation is invalid, in so far as it rests on the statement that by intense light all colours tend towards white. For the apparent whiteness—in the green region, for instance—is only a transitory stage in the production of green blindness, and is reached when the green sensation is reduced to the strength of the underlying blue and red, the mixture of the three being

equivalent to white by candlelight, and, therefore, by courtesy, white." In the majority of the instances given in Dr Burch's paper the region of the spectrum, in which the light used to produce blindness lies, is entirely blotted out, so that evidence of 'whiteness' cannot appear. In the case of blinding by green light the region is not blotted out, and, between the red part of the spectrum on the one hand and the blue on the other, there is a narrow band of an indescribable neutral tint. This indicates practical whiteness in the green region when the strong blinding light is replaced by weaker light. Farther blinding may alter this condition, but does not affect the question whether the intense coloured lights do not themselves appear to be white. It would be of great interest, in the above case, to determine if mixture of the red and blue lights which occur on either side of the neutral band cannot give rise to a neutral light. There is no *a priori* reason why a mixture of lights should not be neutral to a blinded eye although they appear to it to be similar to lights which, when viewed by the eye in an unblinded condition, are not mutually complementary. It is known that apparent absence of colour in light viewed by a colour-blind eye does not prevent that light from exercising its property of complementariness; so that lights which are complementary in normal vision are also complementary in abnormal vision. But the converse is often untrue.

Whatever may be the case with regard to intense light, Dr Burch's conclusion with regard to weak light seems to be fully supported. He finds that some hours of entire rest in darkness may be necessary to get rid of 'dazzle-tints,' that is, coloured luminosity in the eye due to previous exposure to light; and that, when the dazzle-tints have entirely disappeared, "there is no interval between the threshold of light-sensation and the threshold of colour-sensation," so that the feeblest visible light has its colour manifest.

With regard to the third belief, Dr Burch's statement as to the transitoriness of the stage of whiteness in blinding by intense light, would, if verified, prove a negative. A somewhat different phenomenon which I have observed points in the same direction. About three years ago I was making observations on after-images

of coloured objects. In the course of these I looked steadily for some time, in strong lamp-light, at a red table-cover and watched the gradual weakening of the colour, which ultimately became very grey. Quite suddenly the colour changed from greyish but distinct red to a fairly strong green, which could be looked at for some time, though a slight motion of the eyes would cause it to change back to red. The process could be readily repeated. The suddenness of the change was quite startling at first. I ascribed it, at the time, to an action analogous to muscular fatigue. If one pushes against a reverse force, which can just be overcome, the muscles ultimately become fatigued and resist less and less strongly and more and more spasmodically. A sudden uncontrollable diminution of effort at last enables the reverse force to produce reverse motion.

About two years ago I made, quite unintentionally, an observation which negatives the universality of the truth of the fourth statement. Being awake during the night, I was watching the coloured luminosity in the eye—presumably Dr Burch's 'dazzle-tint'—and noting its changes. The main colours are greenish and violet, and these appear to be nearly complementary, for they give rise to a whitish light when they seem to border on each other and presumably overlap. They sometimes change with great rapidity, suddenly spreading out from centres, suddenly breaking up in centres and rolling off throughout the field of vision. At other times they are more fixed. I could see them even against the dark sky, some of the colours being brighter and some darker than the background. As usual, faint stars were visible when regarded indirectly but disappeared when looked at directly. After a time, when the colours were more steady, I found that, by motion of the eyes, it was possible to get the patches removed temporarily from the central parts of the field; and I then saw the faint stars well by direct vision. The usual want of power to see faint objects directly is very tantalising. The pleasure associated with the abnormal power of seeing them best by direct vision is quite indescribable. Continuous withdrawal of the line of vision from them produced continuous diminution of visibility; and, whenever the line of sight was such as to bring the star to the edge of a dark patch of colour in

the field of vision, the star disappeared. It was quite invisible through a dark patch; through a brighter patch it was visible, though apparently less distinct.

It seems therefore that direct vision, when unobstructed by patches of self-colour in the eye, is most effective for perception of small luminous objects. Such a conclusion removes the basis from some theories of the mechanism of vision.

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